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Fee: £25

1. Your reference

39887

2. Patent application number
(The Patent Office will fill in this part)

9814396.9

2 JUL 1998

3. Full name, address and postcode of the or of each applicant *(underline all surnames)*

Mars U.K. Limited
3D Dundee Road
Slough
Berkshire
SL1 4LG
United Kingdom

Patents ADP number *(if you know it)*

5632260001

If the applicant is a corporate body, give the country/state of incorporation

United Kingdom

4. Title of the invention

COAGULATED PROTEIN

5. Full name, address and postcode in the United Kingdom to which all correspondence relating to this form and translation should be sent

Reddie & Grose
16 Theobalds Road
LONDON
WC1X 8PL

Patents ADP number *(if you know it)*

91001

6. If you are declaring priority from one or more earlier patent applications, give the country and the date of filing of the or of each of these earlier applications and *(if you know it)* the or each application number

Country	Priority application *(If you know it)*	Date of filing *(day/month/year)*

7. If this application is divided or otherwise derived from an earlier UK application, give the number and the filing date of the earlier application

Number of earlier application	Date of filing *(day/month/year)*

8. Is a statement of inventorship and of right to grant of a patent required in support of this request? *(Answer 'Yes' if:*

a) any applicant named in part 3 is not an inventor, or
b) there is an inventor who is not named as an applicant, or
c) any named applicant is a corporate body.
See note (d))

YES

Patents Form 1/77

9. Enter the number of sheets for any of the following items you are filing with this form. Do not count copies of the same document.

Continuation sheets of this form	
Description	5
Claim(s)	2
Abstract	
Drawing(s)	3

10. If you are also filing any of the following, state how many against each item.

Priority documents	
Translations of priority documents	
Statement of inventorship and right to grant of a patent *(Patents Form 7/77)*	
Request for preliminary examination and search *(Patents Form 9/77)*	
Request for substantive examination *(Patents Form 10/77)*	
Any other documents *(please specify)*	

11. I/We request the grant of a patent on the basis of this application.

Signature

Date 2 July 1998

12. Name and daytime telephone number of person to contact in the United Kingdom

N S MARLOW
0171-242 0901

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Notes

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COAGULATED PROTEIN

The present invention relates to the preparation of coagulated protein.

Conventionally, protein can be coagulated in a variety of ways, for example by heating it or treating it with acid. It has now been found that a protein may be coagulated by generating free radicals by reacting transition metal ions with an oxidising agent and reacting the free radicals with the protein. A solid foam results. The foam reaction product can be cut into chunks and incorporated into, for example, pet food. If the foam reaction product is compressed, a textured solid mass is produced. The compressed solid mass may have an internal texture similar to that of cooked meat.

According to the invention there is provided a method of coagulating protein which comprises generating free radicals by reacting transition metal ions with an oxidising agent and reacting the free radicals with a protein.

The reaction of transition metal ions with the oxidising agent and/or the reaction of free radicals with the protein may be heated.

Whole blood may be used as the source of protein. The protein may be purified from whole blood before reaction with the free radicals or whole blood may be reacted with the free radicals.

Preferably the oxidising agent is present at at least 0.5% by weight of the protein.

Preferably the transition metal ions are present at at least 0.5% by weight of the protein.

Preferably the protein comprises at least about 5%, preferably at least about 10% by weight of the reaction mixture.

Preferably the transition metal ions are ferrous ions.

Preferably the oxidising agent is hydrogen peroxide.

In a preferred embodiment of the invention there is provided a method of forming a blood chunk comprising heating a hæmoglobin fraction of blood and treating the heated hæmoglobin fraction with hydrogen peroxide.

By the haemoglobin fraction is meant the residue from whole blood once the plasma, or most of the plasma, has been removed. The haemoglobin fraction consists of red and white blood cells with a residue of plasma. The haemoglobin fraction typically contains from about 14% to about 40% protein and about 35% to about 45% red blood cells. The remainder is mainly water together with other blood components.

It will be appreciated that the haemoglobin fraction is a source of protein and ferrous ions. When a blood chunk is formed according to this preferred embodiment of the invention, no addition of transition metal ions is required for coagulation of the protein. When whole blood is used, it may be desirable to add additional transition metal ions.

The reaction product is advantageously then compressed submitting the treated hæmoglobin fraction to pressure.

Preferably the hydrogen peroxide is added to the hæmoglobin fraction at at least 0.5% by weight. There does not appear

to be a significant upper limit to the concentration of hydrogen peroxide in the reaction mixture which is effective to cause the desired reaction to take place; concentrations of up to 3% (by weight) have been found satisfactory.

Preferably, compression is carried out at a temperature greater than 60°C.

Preferably the hæmoglobin fraction is heated to between 60°C and 80°C before addition of the hydrogen peroxide.

Preferably the hæmoglobin fraction comprises at least about 10%, more preferably at least about 15%, by weight protein. At lower protein concentrations, the reaction product does not absorb all the water present in the reaction mixture. Such products are useful and their manufacture falls within the scope of the present invention; however, it will usually be necessary to remove the proteinaceous material from the unabsorbed water before it is used.

Additives may be included in the hæmoglobin fraction to modify the nutritional content and flavour of the chunks. It is preferred that the pH of hæmoglobin fraction is no less than 4, and that it is no greater than 9.

The foamed reaction product of hæmoglobin and hydrogen peroxide can be used as it is. As has already been stated, it can be compressed to give a product having a laminar texture. The compression can be carried out on the reaction product as it is formed, or the reaction product can be stored and then subjected to heating, for example by microwave radiation, prior to compressing. Alternatively, the reaction product may be steamed to give a product having a jelly-like texture. The steaming can be carried out with meat juices or other flavoured aqueous media to impart particular flavours to the product.

The product can be dried, preferably at about 60°C, to produce hard, crunchy chunks, which are useful as a dry pet food.

The pressure at which the reaction product of hæmoglobin and hydrogen peroxide is compressed to achieve the laminar internal structure is not critical; a pressure of up to about 400 kPa is preferred.
Also according to the invention there is provided a solid foam comprising a major proportion of blood protein.

Also according to the invention there is provided an edible chunk comprising a major amount of blood protein and having a fibrous, laminar internal structure.

The invention will be further described, by way of example, with reference to the drawings in which;

Figure 1 shows schematically a method according to a first embodiment of the invention;

Figure 2 shows schematically a method according to a second embodiment of the invention; and

Figure 3 shows schematically a method according to a third embodiment of the invention.

The methods according to the invention shown in the drawings include the following common features. The hæmoglobin fraction of blood is pumped from a tank 10 by a peristaltic pump 12 to a steam infuser 14 where the hæmoglobin is heated to about 75°C. The heated hæmoglobin passes from the steam infuser 14 to a high shear mixer reactor 16, such as a Dispax reactor. In the Dispax reactor, the hæmoglobin is reacted with hydrogen peroxide pumped from a hydrogen peroxide tank 18 by a hydrogen peroxide pump 20. In the reactor 16, the hæmoglobin and the hydrogen peroxide are

mixed efficiently. Preferably, the reactor is a high shear, low volume mixer to ensure adequate mixing of the two components.

In the first embodiment of the invention, shown in Figure 1, the foam reaction product 22 is deposited in a tray 24. The reaction product 22 can be allowed to be compressed by its own weight, in which case the solid mass produced is elastic and can be cut up to provide elastic chunks. Alternatively, pressure can be applied to the reaction product 22 in the tray by application of a pressure plate 26. On release of the pressure plate a solid product 28 having a fibrous, laminar internal structure is produced, which can then be cut into chunks 30 as at 32.

In the second embodiment of the invention, shown in Figure 2, the reaction product 22 from the reactor 16 is passed to a piston pump 40 in which the reaction product is compressed. As the reaction product 22 leaves the piston pump 40, it is diced as at 42 to produce chunks 44 having a fibrous, laminar internal structure.

In the third embodiment of the invention, shown in Figure 3, the reaction product 22 leaves the reactor 16 through a disperser 50, from where it passes into a mouth formed by the widely separated ends of two converging continuous belts 52, 44. The reaction product is compressed between the two continuous belts, and the resulting solid sheet 56 is cut into chunks 58 as it leaves the continuous belts 52, 54, as at 60. Again, the chunks produced have a fibrous, laminar internal structure.

The chunks have a fibrous, laminar internal structure, similar to that of meat chunks, so that the chunks can be readily used in canned food stuffs such as pet foods to provide a protein source which is analogous in appearance and texture to meat.

CLAIMS

1. A method of coagulating protein comprising generating free radicals by reacting transition metal ions with an oxidising agent and reacting the free radicals with a protein.

2. A method according to claim 1 further comprising compressing the reaction product of the free radicals and protein.

3. A method according to claim 2 in which the compression is carried out at a temperature greater than 60°C.

4. A method according to claim 2 or 3 in which the compressed product is dried.

5. A method according to any preceding claim further comprising steaming the reaction product of the free radicals and protein.

6. A method according to any preceding claim in which whole blood is reacted with the free radicals.

7. A method according to any preceding claim in which the transition metal ions are ferrous ions.

8. A method according to any preceding claim in which the oxidising agent is hydrogen peroxide.

9. A method according to any preceding claim in which the oxidising agent is present at at least 0.5% by weight of the protein.

10. A method according to any preceding claim in which the transition metal ions are present at at least 0.5% by weight of the protein.

11. A method according to any preceding claim in which the protein comprises at least about 5%, preferably at least about 10%, protein by weight of the reaction mixture.

12. A composition for forming coagulated protein which comprises: protein, transition metal ions and an oxidising agent.

13. A coagulated protein formed by a method according to any of claims 1 to 11.

13. A solid foam comprising a major proportion of blood protein.

14. An edible chunk comprising a major proportion of blood protein and having a fibrous, laminar internal structure.

15. A method substantially as described.

16. A chunk substantially as described.

Fig. 1

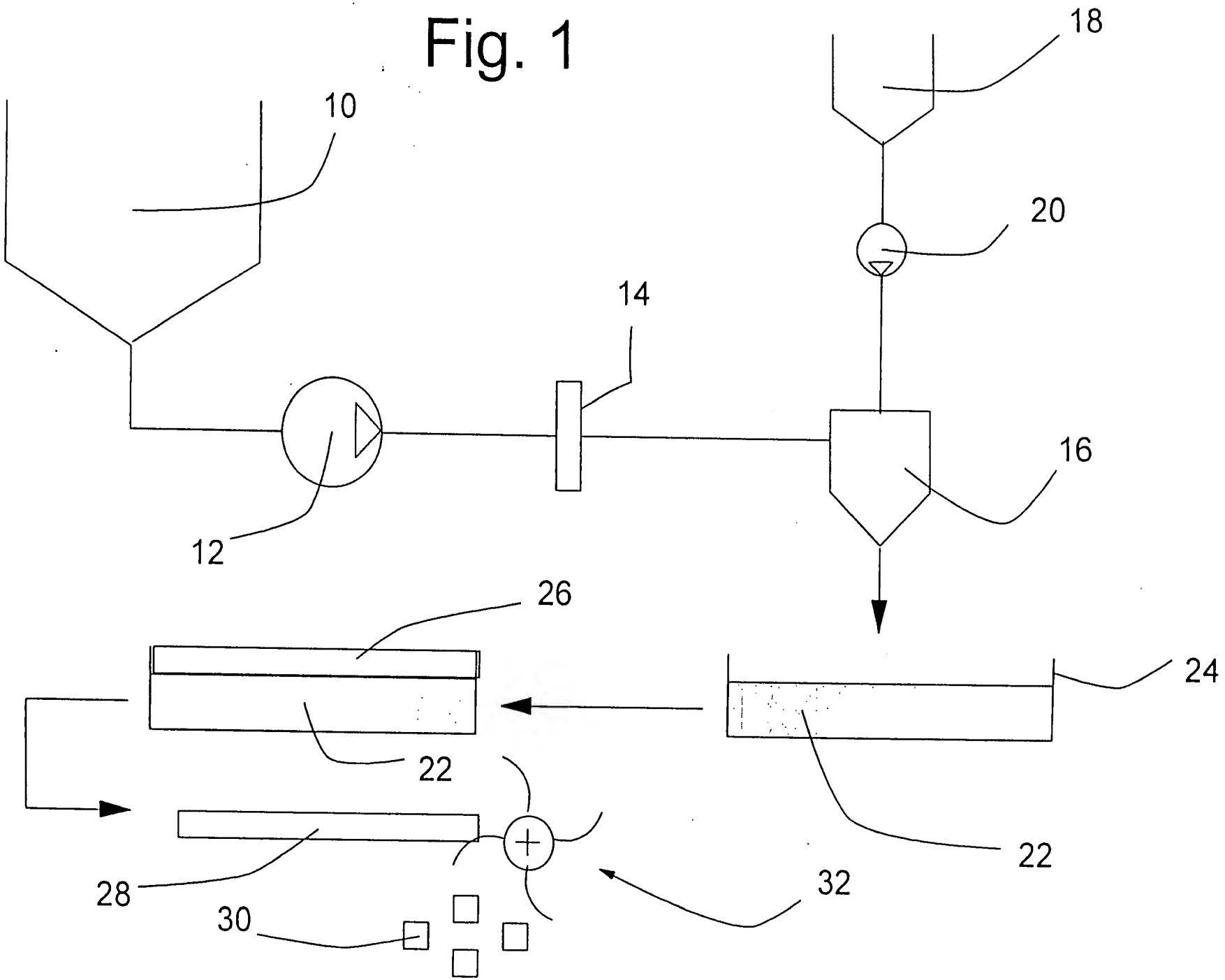


Fig. 2

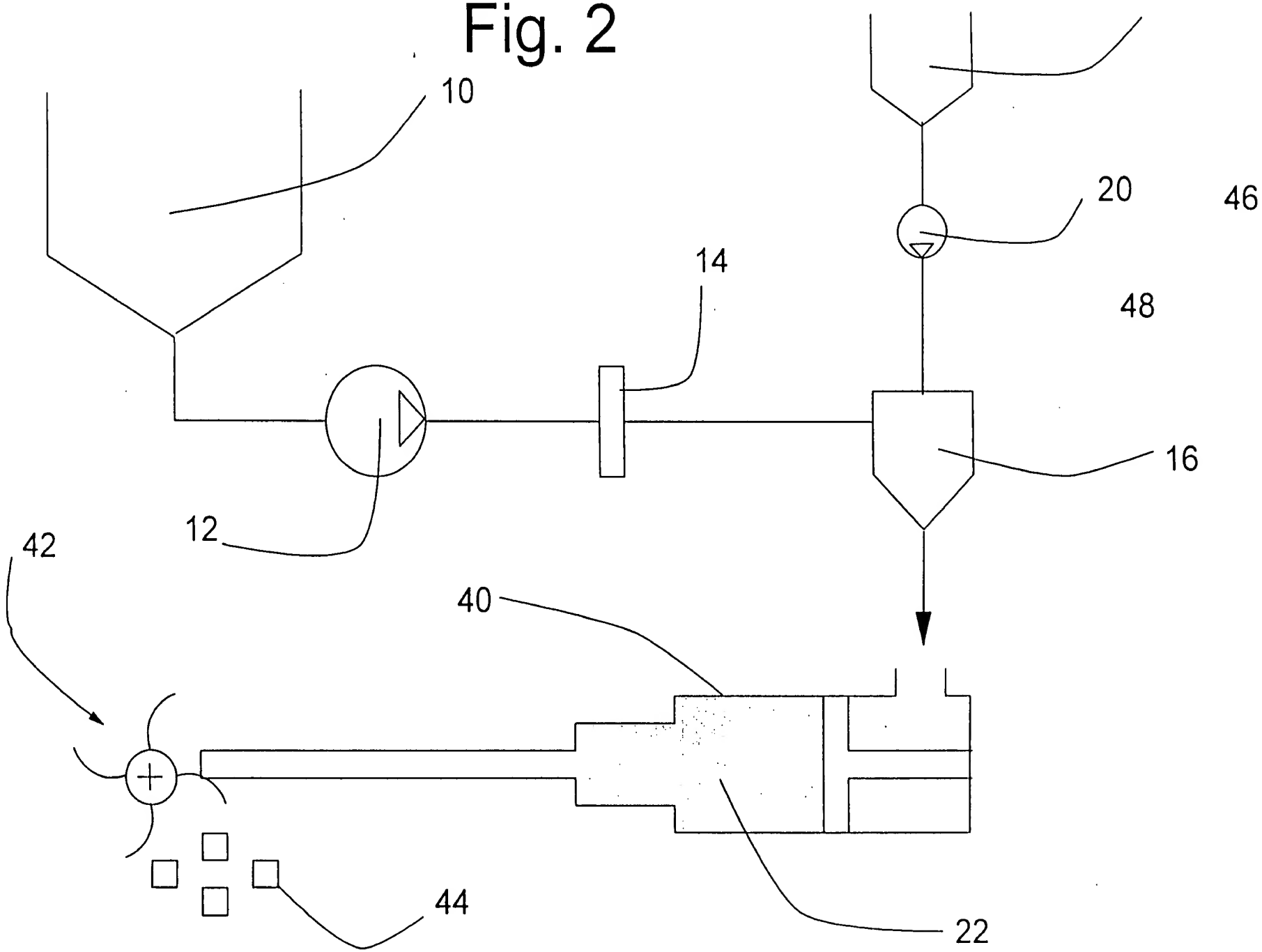
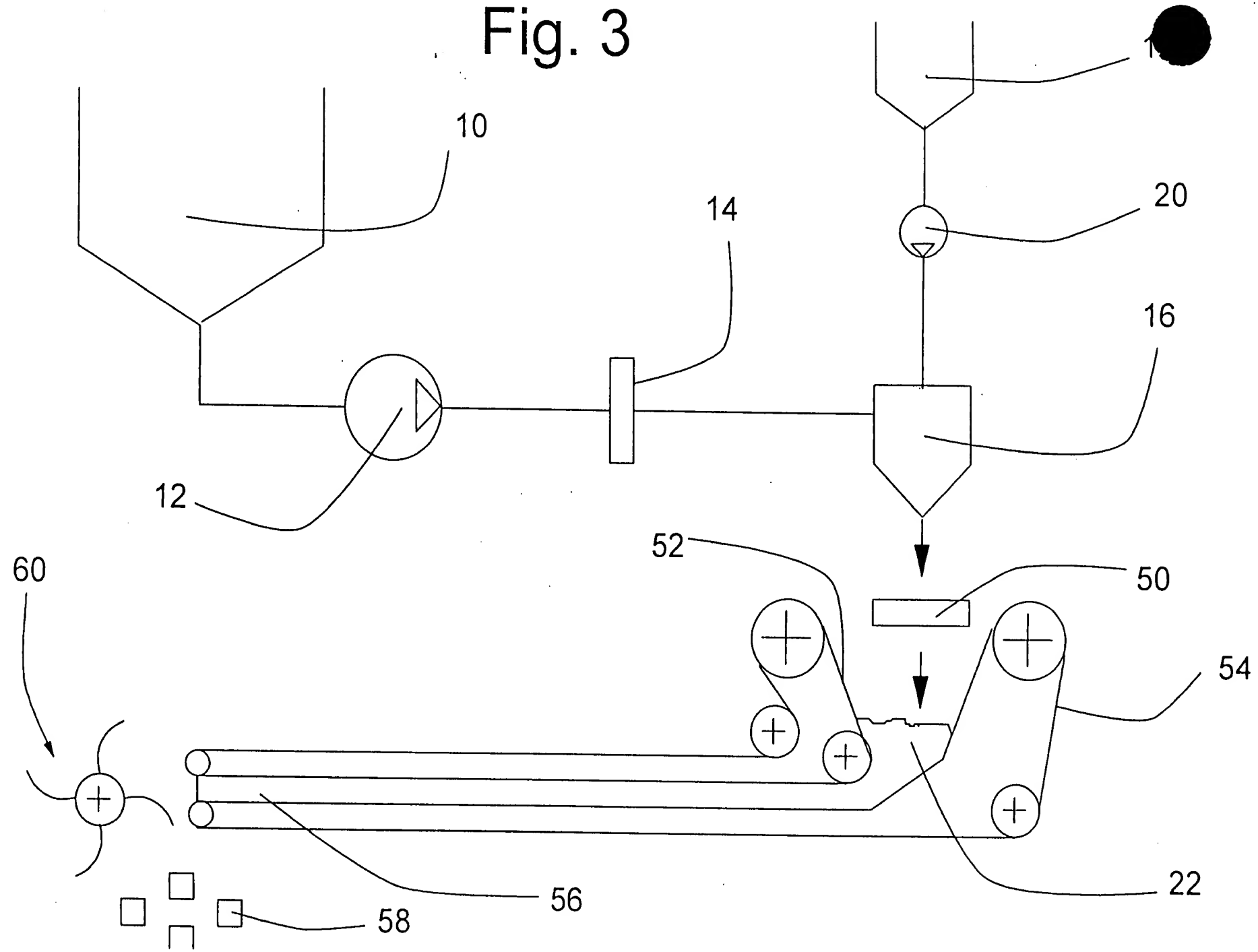


Fig. 3



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